

# Optimized Rail Pads

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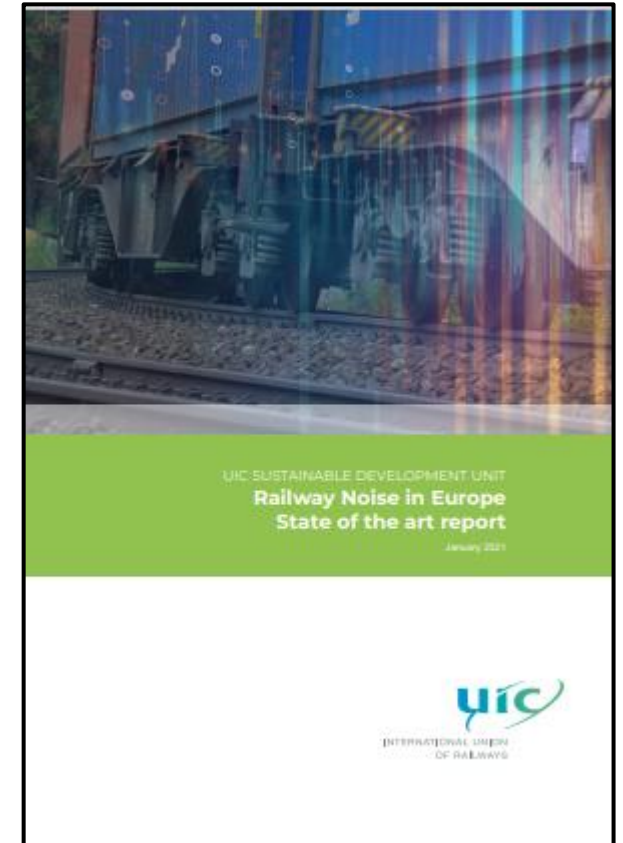


# Agenda

1. How rail pads fit into the noise mitigation picture
2. Requirements for rail pads
  - General
  - Retrofitting
  - Track renewal or new construction
3. Noise assessment criteria
4. UIC «LOWNOISEPAD» Project
5. Conclusion

# How rail pads fit into the noise mitigation picture

- **More noise reduction required:** Important changes in Swiss railway noise legislation are on the horizon
  - **BGLE expires:** BGLE (Federal Law on Railway Noise Abatement) expires in 2028 (e.g., ban on noisy freight wagons, rail roughness limits, funding research, closing gaps in LSW, etc.)
  - **EKLB Report:** EKLB (Federal Commission for Noise Abatement) published proposal for new stricter noise limits at end of 2021. Revision of the Noise Abatement Ordinance (LSV) likely.
  - **New WHO Guidelines, new studies:** All point towards lower limits
  - **Regulation concept:** Report (not public) commissioned by BAFU proposes legal changes. Includes e.g., reduction of "privileges" for existing lines
- **But:** More noise protection is difficult and expensive:
  - more noise barriers generally not favored
  - Other measures with effect of only 1 -3 dB (depending on initial situation)
    - Most technical measures do not have a high technical readiness level
    - Interaction with other elements of railway system must be considered
    - Problems with diagnostics and maintenance of tracks and vehicles



Railways cooperate internationally on noise mitigation issues

## Improved rail pads could be part of the solution

- Rail pad is an existing component of track
  - No problems with maintenance or diagnostics
  - Can be combined (technically and acoustically) with other noise mitigation methods i.e., noise barriers, vehicle measures
- Inexpensive component of the track
- Can be retrofitted (under certain conditions) or installed during track renewal
- For SBB (with stiff rail pads) expected general effect is around 1 dB noise reduction: But even a small noise reduction is useful.
- Additionally: Optimized rail pad can also lead to savings in maintenance, although not quantified to date
- **Conclusion: Optimized rail pads do not solve all noise problems, but can be part of the solution**



Photo: EMPA

Installation of new rail pads in Nottwil

# SBB technical requirements for rail pads

- **Rail pad geometry (for B91 sleeper and 60E2 rail):**
  - Length and width: 148 mm x 180 mm
  - Thickness 7 mm (no change in thickness over time)
- **Lifetime:**
  - Must comply with EN 13146
  - Lifetime at least 20 years (as long as the rail)
- **Stiffness:**
  - Static stiffness for retrofitting:  
min 200 kN/mm, max 400 kN/mm
  - Static stiffness for track renewal or new construction:  
min 60 kN/mm
- **Noise:**
  - Noise reduction at least 1 dB better than standard stiff EVA pad (see next slide for methodology)



Photo: SBB CFF FFS

Semperit rail pad installed in Nottwil

# Federal legal and SBB policy requirements for rail pads

- **Railway safety requirements:**
  - Introduction of new elements for track tests requires a written permission of BAV (Track department)
  - General use in track requires a second stage of written permission, after successful completion of initial track tests.
  - Currently, SBB has installed the test pads without any formal approval, further tests cannot be done without it
- **Purchasing law (BöB/VöB):**
  - Rail Pad and its properties need to be specified in a generic way to allow for a public tender
  - Tender process already needs to start at the field test stage, not only after the approval for general use.
  - Rail pads cannot just be bought from a given supplier
- **Redundant suppliers:**
  - SBB needs at least two equally qualified suppliers for a crucial product in general use.



Photo: SBB CFF FFS

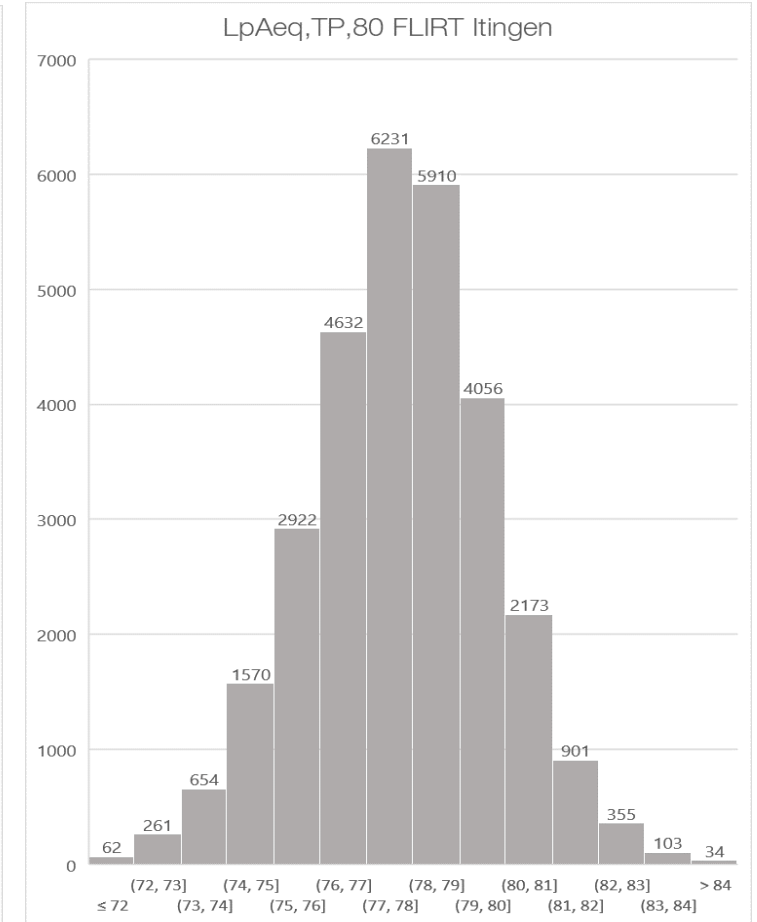
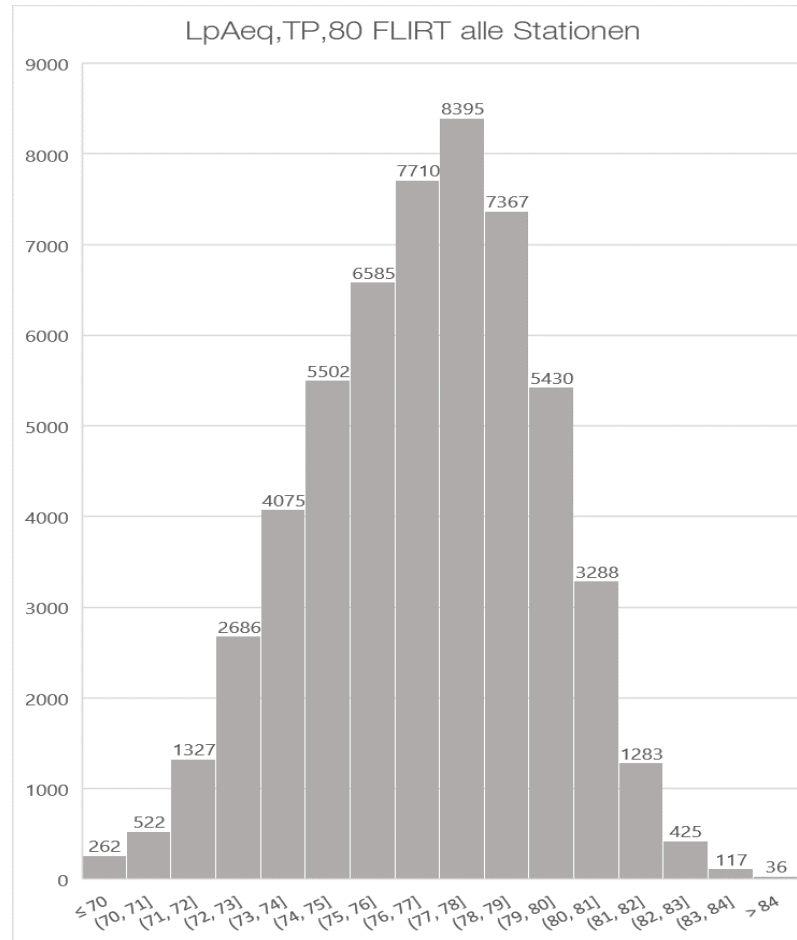
EVA rail pad installed  
in track

# Noise evaluation criteria

## Example: FLIRT train

There is a **large variability** in noise measurements

- One train type, all monitoring sites
  - FLIRT train, SD: 1.7 dB (95 % of trains are within  $\pm 3.4$  dB)
- One train type at a given location
  - FLIRT train, SD: 1.5 dB (95 % of trains are within  $\pm 3$  dB)



Source: SBB CFF FFS

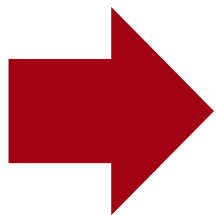
All six monitoring stations  
(measurements of more than 50'000 trains)

Monitoring station in Itingen  
(measurements of more than 30'000 trains)

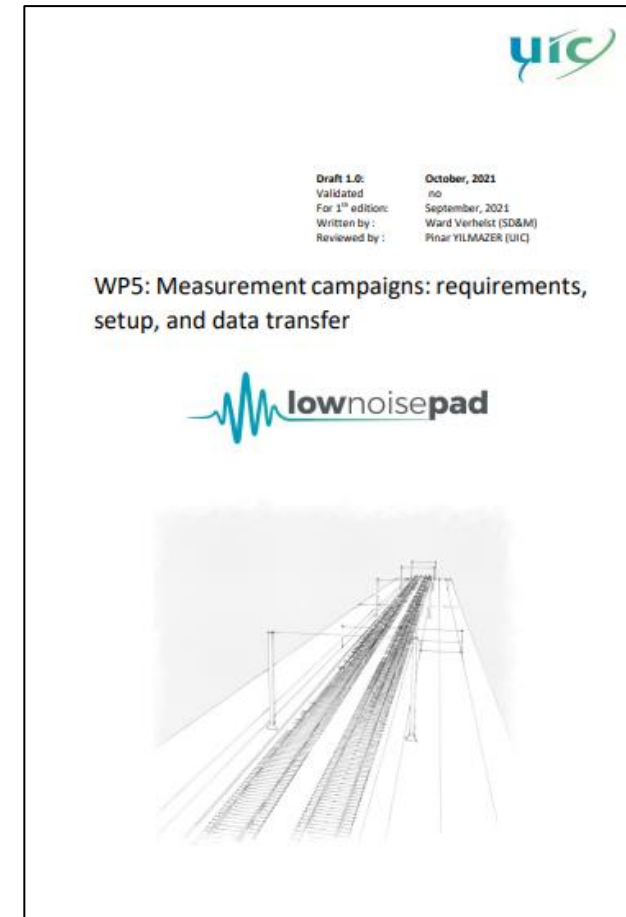
# Noise Evaluation Criteria: consequences

Variability leads to the following consequences for noise measurements and analysis

- Large number of pass-by measurements necessary
- Reference track must be as similar as possible to installation section
- Before and after measurements as well as comparison with reference track
- Rail roughness measurements necessary
- Axle by axle comparison of noise levels useful
- TDR measurements required as an additional input and helpful for validation
- Statistical analysis of results required (due to variability, differences may not be significant)



**Good design and statistical analysis necessary**



Measurement Guideline by UIC for LOWNOISEPAD Project



# UIC LOWNOISEPAD Project

## Process:

- Participation of 12 infrastructure managers
- Installation of 100 m optimized rail pad
- Comparison of noise and TDR with adjacent reference track
- Collection of all possible noise, TDR and track component data into a large data set

## Anticipated result:

- Effects of track parameters on TDR and noise
- Potential for optimized rail pad for different tracks
- Software Tool to determine noise effects of optimized pads based on TDR measurements
- Results in Spring 2023

## SBB contribution:

- Nottwil data
- Allows comparison in larger context



## Conclusion

- Optimized rail pads are an interesting option towards reducing railway noise and improving maintenance
- Railway requirements must be met
- Softer static stiffness should lead to LCC improvement
- Noise reduction claims must be statistically proven

Stiff EVA rail pad

New Semperit rail pad



Photo: SBB CFF FFS

Nottwil